Religious paths between seismic activity and cultural evolution

Eric R Force
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Introduction

The link between the tectonic activity along active plate boundaries and the complexity of ancient cultures found near those boundaries seems adequately established. It was first broached in Force (2008) and Force and McFadgen (2010) and elaborated in my book (Force 2015). Other authors (reviewed in Balmuth et al. 2005, Grattan and Torrence 2007) have acknowledged some form of connection between these seemingly separate phenomena.

The dynamics of the relation have several components as discussed by Force (2015). These include water supply, war, and trade, but invariably involve accelerated change. Religious connections were introduced in two contexts, first in the Hebrew literature and then in analogous cases in the modern world of religious responses to tectonic activity. Especially clear are religious responses to volcanic activity, in both ancient and modern cultures (reviewed in Balmuth et al. 2005, Grattan and Torrence 2007).

More recently I have encountered additional evidence (some of it thanks to Stewart and Piccardi 2018) that the effect of seismic activity on the process of cultural complexification occurs via religious response. Perhaps this should have been obvious, as human response to earthquakes inherently goes beyond previous experience into otherworldly realms. But details of the relation vary, and deserve proper description. The purpose of this paper is therefore to approach this documentation from a variety of directions and viewpoints, and thereby reveal the dynamics and motivations. I begin with a section addressing coinciding distributions of religious and tectonic phenomena. I then look at particular histories where these phenomena coincide, then back off to look at converse cases.

I. Plate tectonics and the origins of today's big religions
Back about 2005, as I was preparing a paper comparing plate-tectonic boundaries with originating sites of ancient complex cultures, my former colleague Henry Spall at US Geological Survey pointed out that a similar case could be made for the originating sites of world religions. I did not include his information in Force (2008) but it gains urgency as evidence of links between religiousity and tectonic activity emerge (Bentzen in press) and as the evolution of big religions is addressed (e.g. Norenzayan et al. 2016). It seems possible that tectonic activity catalyzed religious change to begin this evolution.

In this section I will compare the big religions of today via their originating sites to the plate tectonic environments of those sites. I keep my information base obvious and accessible, using Wikipedia where possible.

Table 1 compares today’s religions numbering adherents over a million (from Wikipedia for 2018), with the tectonic environments of the originating sites for each, listed as distance to the nearest plate-tectonic boundary. For on-land plate boundaries I mostly use data from Force (2008) as in figure 1; these include transcurrent, spreading, and collisional boundaries. Because seismic activity is related to plate boundaries, it should also be possible to do this analysis using seismic hazard information.

Taking an unweighted arithmetic average of site-distances from table 1 gives 239 km, a remarkably small average distance on a globe with thousands of kilometers of distance available for founding religions. Indeed these originating sites form a cluster around tectonic boundaries that represent only 5.6 percent of the available land in the eastern hemisphere alone. (Even if the distance for Confucian/Tao had been listed as 1500 km, the average would still be only 251 km; see note with table 1).

We could calculate the chance that the distribution is random (as I did in 2008 for ancient complex cultures), but perhaps the reader can accept that this chance would be one in several million. Regardless of causes, there is a strong spatial association of active plate tectonic boundaries with religious origination.

Perusing table 1 also gives one the impression that religions with the most adherents originated closest to tectonic boundaries. An average weighted by number of adherents is called for. Dividing the product of adherents and distance by the number of adherents gives 75.7 km for the average adherent-distance for originating sites, a much
smaller distance confirming that religions with the most adherents tended to originate closest to plate-tectonic boundaries. It’s clear from the table and figure 1 that the northern margin of the Indian plate and the western margin of the Arabian plate were the locus of origination of disproportionately many religions, and those with many adherents.

My use of the Wikipedia list for a metric (and probably any such list) obscures great complexities—list-aggregated religions each with many adherents, religions so fractured that their adherents are shooting at each other, etc. A more sophisticated treatment seems warranted in view of the strength of my simple analysis.
Table 1.—Plate tectonic positions of world religions’ originating sites, ranked by number of adherents by Wikipedia (2018). Notes: Omitted from the Wikipedia list are Irreligious, ethnic/indigenous, African indigenous, spiritism, and neopagan, i.e. religious categories that are composite and have no single origin. Similarly Zoroastrianism is omitted from calculations due to lack of definite origination site; plate boundaries Af, African; Ar, Arabian; In, Indo-Australian; Ea, Eurasian; PO Philippine and Okhotsk plates; 3. Hastinapura taken for the coalescence of the religious traditions that became Vedic Hinduism, 4. Bodh Gaya is traditional but most sites such as Kushinagar are about 110 km. That is, Gautama’s spiritual journeys and observations were in tectonically active terrain but enlightenment was more quiescent, 5. Confucianism and other traditional Chinese religions are thought to have been codified in Zhou times in their capital. The distance listed is that to the Altyn Tagh-Qinling fault system, a proto-plate boundary as discussed in Force (2015). Otherwise the listed distance would be about 1500 km.

<table>
<thead>
<tr>
<th>Rank and name</th>
<th>Adherents (million)</th>
<th>Originating site</th>
<th>Distance to boundary (approx km)</th>
<th>Plate boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Christian</td>
<td>2400</td>
<td>Jordan Valley</td>
<td>0</td>
<td>Af-Ar</td>
</tr>
<tr>
<td>2. Muslim</td>
<td>1800</td>
<td>Mecca</td>
<td>100</td>
<td>Af-Ar</td>
</tr>
<tr>
<td>3. Hindu</td>
<td>1150</td>
<td>Hastinapura</td>
<td>100</td>
<td>In-Ea</td>
</tr>
<tr>
<td>4. Buddhist</td>
<td>521</td>
<td>Kushinagar</td>
<td>110</td>
<td>In-Ea</td>
</tr>
<tr>
<td>5. Tao/Confucian</td>
<td>394</td>
<td>Zhou</td>
<td>300</td>
<td>(see note)</td>
</tr>
<tr>
<td>6. Sikh</td>
<td>30</td>
<td>Kartarpur</td>
<td>0</td>
<td>In-Ea</td>
</tr>
<tr>
<td>7. Judaism</td>
<td>14.4</td>
<td>Jordan Valley</td>
<td>0</td>
<td>Af-Ar</td>
</tr>
<tr>
<td>8. Bahai</td>
<td>7</td>
<td>Acre/Haifa</td>
<td>60</td>
<td>Af-Ar</td>
</tr>
<tr>
<td>9. Jain</td>
<td>4.2</td>
<td>Patna</td>
<td>160</td>
<td>In-Ea</td>
</tr>
<tr>
<td>10. Shinto</td>
<td>4.0</td>
<td>ca. Kyoto?</td>
<td>500</td>
<td>PO-Ea</td>
</tr>
<tr>
<td>11. Cao Dai</td>
<td>4.0</td>
<td>Tay Ninh</td>
<td>1300</td>
<td>In-Ea</td>
</tr>
<tr>
<td>12. Zoroastrian</td>
<td>2.6(?)</td>
<td>unknown</td>
<td>n.a.</td>
<td></td>
</tr>
</tbody>
</table>
Of course many of the religions listed here now occupy huge tracts of tectonically quiescent continents. The current distribution of Christianity, for example, would bear little resemblance to plate-tectonic boundaries, indeed several religions have migrated far away from their origination sites.

On the other hand, some tectonic plate boundaries became religious boundaries that persist to the present day. Perhaps most obvious is the northeastern margin of the Indo-Australian plate within the Indian sub-continent (fig. 1) between Hindu (to SW) and Buddhist/Chinese Tibetan (to NE) domains. In this case, the new religion, which had originated on a tectonic plate boundary, moved toward tectonically quiescent terrain on the side less permeated by its Hindu parent.

This process is described for us in detail on another plate boundary, for another new religion. Whatever its historical value, the biblical book of Acts describes rejection of Christianity by the parental Hebrew community, contrasting with ready acceptance by Greeks, resulting in migration of the new religion off its originating site on the African-Arabian tectonic boundary into the Greek community of present-day Turkey, i.e. onto the Hellenic-Turkish plate.

What catalyzes a perceived need for a new religion? I think the origination of religions in regions of high seismicity is quite understandable. The experience of surviving an earthquake is profound, even other-worldly, we are told by many survivors. Such experience is the province of religion. Survivors tend to see their previous religions as inadequate, and may formulate new ones. Reformulation of religion has commonly followed seismic activity directly (my next section). Influence of volcanic activity on religious practice is well described in a voluminous literature of its own. Thus the initiation of new religions along plate-tectonic boundaries is not only descriptively persuasive based on distribution, but also dynamically understandable based both on human nature and on repeated histories.
Figure 1.—Locations of originating sites of major world religions (numbered as in table 1) relative to tectonic plate boundaries on or near land, modified from Force (2008). P and O are Philippine and Okhotsk plates respectively.
II. Direct religious responses to seismicity--punctuation marks in religious histories

Some critical response to my first section holds that a culture’s religion is inseparable from the whole of its cultural aspects, and therefore that my posting basically treats a cultural phenomenon. And so some of these responders familiar with my book (Force 2015) say that the correspondence of tectonic boundaries and origination of religion simply echoes the cultural correspondence I demonstrate there. I see this is a question that I myself have made more difficult.

Therefore this section is required to show that these variables—culture and religion—are separable based on people’s elemental responses to tectonic activity. Below I list cases where religious responses are sufficiently well described to link them definitively to tectonic events.

I have listed only responses to earthquakes rather than including volcanic eruptions, as these can be quite different. Earthquakes generally seem totally other-worldly and unexpected, so that religious response begins at the event, whereas people living near a volcano are generally aware of that, and religious practice consequently focuses on pre- and syn-eruption protection (and in some cases volcano veneration). These are numerous and persuasive; volcanic ties with culture and religion have a literature of their own (e.g. Balmuth et al. 2005). These ties have been catalogued by Chester and Duncan (2007), consisting of at least 41 examples, 25 after 1850 and 16 before. To their comprehensive compilation I can add only a few (Oviedo 1529, Hamilton 1776, Elson 2007, Barnes in press).

The list below documents the religious responses I’m aware of to earthquakes, ranging from antiquity to the modern world. Most pre-modern (and some modern) earthquakes have insufficiently recorded and preserved cultural responses, whether secular or religious, so this list is just a sampling. Not included are those pre-modern religious events—such as death of a prophet—accompanied by earthquakes, as these were easily manufactured after the fact to maximize impact. However, one such link is included in which a religion’s appeal was changed. Also omitted are creation myths that involve earthquakes. Tsunami are included regardless of origin. The listed links vary from profoundly religious to practically incidental. In a few remarkable items
the link is directly to ancient fault activity rather than to earthquakes per se.

Pre-1300 BC: Mycenae, unusual cultic focus on recently formed fault scarp (Force and Rutter, 2018)

Ca. 750 BC: an earthquake predicted by Amos (1:1) began the entire earthquake theophany of zealous prophets (Freedman and Welch 1994), described in some detail in my following section.

8th to 4th cent. BC: Delphi episodic gas release with active faulting as basis of veneration (Stewart and Piccardi 2017)

5th cent. BC: Ephesus temple sited on active fault scarp with votive (Stewart and Piccardi 2017)

4th cent. BC: Cnidus (Turkey) as at Ephesus (Stewart and Piccardi 2017)

3rd cent. BC: Heiropolis (Turkey) priestly manipulation of fault-motion consequences (Stewart and Piccardi 2017)

Ca. AD 32: “Holy Land” death of Jesus, earthquake suggests divinity recognized outside Judaism (Matthew 27:51-54)

AD 77 then 365-400: Kenchraea (Greece), earthquake-submerged port becomes Christian basilica, then that is abandoned due to recurrent submergence (Scranton 1978)

Ca. AD 100: Philippi (Turkey), earthquake releases Paul and Silas from prison, converts jailer (Acts 16: 26-31)

AD 410: Corinth, earthquake destruction of “pagan” temples divert populace toward Christianity, now “official” (Rothaus 1996)

AD 1157 and 1170: Syria, “holy land” sieges and battles between Crusaders and Moslems postponed by earthquakes, then influenced by damage (Raphael 2010)
AD 1257: Kamakura (Japan), rise of lotus sect spurred by earthquake (deBoer and Sanders 2005)

15th cent. AD: New Zealand Maori belief systems shift with occupation patterns due to earthquakes and tsunami (McFadgen 2007)

c. AD 1500: Italy, political manipulation of religious response to earthquakes (Belloc et al. 2016)

AD 1638, 1727, and 1755: New England, the Mathers both father and son use each of these three earthquakes to push religious purification (Rozario 2007)

AD 1755: Lisbon earthquake first blamed by clerics on impious populace, then reversed by Marquis de Pombal, meanwhile used by Voltaire to address question of God’s permitting evil (many authors e.g. de Boer and Sanders 2005; Hough and Bilham 2006, Robinson 2016)

AD 1786 Lituya Bay AK, some Tlingit clans form tectonically related religions, largely in response to tsunami (Emmons 1911, Howell and Grant 2016)

AD 1812: New Madrid MO earthquake increases local religiousity, blamed by Tecumseh on Great Spirit (Rozario 2007 p. 57-9, Hough and Bilham 2006 p. 82-3)

AD 1812: Caracas, Bolivar describes priestly manipulation of earthquake damage (Robinson 2016)

AD 1855: Edo (Japan), religious imagery of earthquake initiated (Robinson 2016)

AD 1883: Krakatoa tsunami sparked Islamic fundamentalist reform (Winchester 2003)

AD 1906: San Francisco, Christian Science revival after earthquake (Winchester 2006)
AD 1923: Kanto (Japan), changes in Shinto religion permitted militarism, exacerbated intolerance (Robinson 2016)

AD 2011: Christchurch (New Zealand), increase in religiousity after earthquake (Sibley and Bulbulia 2012)

So dozens of examples show direct linkages between earthquakes and religious responses, representing a wide range of time periods in different parts of the world. It seems permissible to generalize that earthquakes are religious punctuation marks. Indirect links between earthquakes and religion seem unnecessary when direct links are so numerous. In several cases priests used earthquakes to manipulate the laity. In several others the religion is reformed in some way, making origination of a new religion (as in the last section) quite plausible.

This result is in accord with dozens of additional links between religious responses and volcanic eruptions (Balmuth et al. 2005, Chester and Duncan 2007). Those links are apparently not in dispute.

In the modern world links between earthquake-prone environments and religiousity are so strong as to be reduced to statistics and even equations (Bentzen in press). Indeed it seems likely to me that the link between tectonism and culture occurs via religious responses in a majority of cases. In those cases religious response to tectonism is the horse that pulls cultures along behind.

If this is so, we would like to see details of the process, and my next section focuses on one culture’s example.
III. Earthquakes in the Bible—the role of “earthquake theophany”

The Bible is by far the most detailed narrative with which to track the influence of tectonism on the evolution of a religion. Other approaches such as my previous two sections need to be fleshed out with examples that reveal detail, motivation, and dynamics.

The “Holy Land” is astride the junction between two big tectonic plates moving nearly-horizontally past each other (e.g. Yeats et al. 1997). Seismic activity has been high all through its history (Ben Menahem 1991). If tectonic activity plays a part in religious developments, it should be evident here.

From the point of view of response to earthquakes, the Bible including the New Testament shows a continuum that gathers strength through time. For chronologic order I’ll divide the discussion, first into books that cover creation through Moses and Israel’s kings to ca. 587 B.C., i.e. the Torah and “Deuteronomistic” books, then the prophetic tradition, which continues into the New Testament.

Many readers may be puzzled at my title, so: Theophany is defined as God’s appearance to humans. His appearance in conjunction with earthquakes is not my conclusion, but I explore and extend the concept; biblical scholars, archaeologists, and geophysicists have documented almost all the parts of this relationship in their technical journals.

The Torah and “Deuteronomistic” books

Earthquakes accompany several important turning points in early Jewish religious history, indeed God begins his habit of appearing in earthquakes in some of these events, the others being merely miraculous. Some of the events are described in text fragments of great antiquity, for example:

In Exodus 19:18ff, Moses encounters Jehovah on Sinai, which seems to be a volcanic eruption as noted by Cross (1997), but shaking is also recorded as sometimes happens with eruptions. This passage is part of the ancient J-document component of the Torah (R. E. Friedman 1987, p. 251). This would appear to be the first example of “earthquake theophany” as discussed below.
In Numbers 16:30ff, Moses predicts an opening of the earth in a hostile test of his connection with God, and is successful. God does not appear but causes the miracle to support Moses. That is, the text is not theophanic but it does begin a related prophetic tradition. R. E. Friedman (1987, pp. 193-196, 253) shows that this too is an ancient J document, in this case overprinted by a later priestly addition. The earth is not described as shaking, but the “clave asunder” (KJV) and its immediate closure would appear to require active tectonism and are accepted as an earthquake by Friedman.

The Torah as it currently appears is a composite of different documents derived from different regions and with different biases. Final assembly was quite late, but some of the constituent documents including the two earthquakes described above are as ancient as 800 B.C. or before. Some of these may have originated as oral traditions.

The first few following books—through II Kings—called Deuteronomistic, were completed after the fall of Judah in 587 B.C. but present a chronology of events in the formation of the state of Israel relative to its religious practices, focusing on the era of King David, ca. 1000 B.C. Some traditional components of this literature are thought to have originated in that era. For example, Psalm 18 (and its repetition in II Samuel 22) is thought to be of great antiquity, and David’s pleas to God for help do produce an earthquake in verse 7. The Song of Deborah in Judges 5, also thought to be of great antiquity (e.g. Coogan 2011, p. 214), mentions earthquakes as God emerges in battle for Israel. In I Samuel 14:15, King Saul prevails over his enemies with an earthquake provided by God (verse 23). These examples range from theophany to simple miracles but certainly get the attention of his God-fearing people.

Psalms 29:8, 46:3, and 68:8 also feature earthquakes but more in the spirit of God’s wondrous power, and some of these psalms are thought to be later. We get a glimpse of the recording of oral tradition in Proverbs 25:1 where oral proverbs nominally originating with Solomon were copied down by Hezekiah (715-687 B.C.).

An interesting window into one mindset that produced these books is provided by I Kings 19:11, where an earthquake and storm occurred “as the Lord passed by.” However, “the Lord was not in the earthquake”, building up to “a still small voice” addressing Elijah (all KJV). The intentional anticlimax is puzzling.

Archaeoseismologists have discovered evidence of some earthquakes from this period that are not attributed as such in the Bible.
The best case in my opinion can be made for earthquakes in conjunction with the fall of Jericho (Joshua 6:1-16). There is buried evidence of earthquake in a time frame that would include Joshua (Kenyon and Tushingham 1953, Kenyon 1979). The method of construction of Jericho’s walls made earthquake reconstruction easier but resulted in repeated damage. Jericho is of course located right on the active faults forming the boundary between Arabian and African tectonic plates.

The prophetic tradition

Religious fascination with earthquakes kicked into a higher gear with the onset of the main prophetic tradition. This tradition begins with one particular earthquake of about 760-750 B.C. (Dever 1992, Ogden 1992, D. N. Freedman and Welch 1994, Austin et al. 2010). Its apparent prediction by the prophet Amos set the pattern for subsequent prophets for almost a millennium (indeed recognizable in present-day preaching).

The book of Amos begins “. . . two years before the earthquake” (Amos 1:1, KJV) with his prophesy of that earthquake—or at least taken to be of that earthquake once it occurred. An extremely severe earthquake did occur; the archaeological record of this earthquake has been documented over quite a large area of Israel, southern Lebanon, and SW Syria (Dever 1992, Austin et al. 2010). Amos basically says that God will both cause and appear in the earthquake, and subsequent prophets accepted that, making this earthquake theophanic (D. N. Freedman and Welch 1994).

Some readers will find it remarkable (as it once was to me) that the seemingly obscure book of Amos, inserted among other “minor prophets” toward the end of the Old Testament (Hebrew Bible), is quite ancient, from the Middle Iron Age (Iron IIb). Actually there is a huge literature on Amos; he is not obscure to Biblical scholars. Amos is the oldest of the prophetic-tradition books; indeed, Amos is probably among the older extensive works of literature in paleo-Hebrew, based on references to rulers, neighboring states, writing style, and the archaeological evidence (e.g. Anderson and D.N. Freedman 1989, D. N. Freedman and Welch 1994). We have seen that Biblical books that treat pre-Amos events include many components that were composed before Amos, but which were compiled after Amos’ time into the composite Biblical books as we read them today (e.g. R. E. Friedman 1987).
Subsequent prophets (Isaiah 5:25, Zechariah 14:5) mention the impact of “Amos’s” earthquake. But most interesting is the tradition of earthquake prediction—and threats—that followed through the entire prophetic tradition of the Old Testament, so that Amos’s earthquake became a foundation of Judaic religious patterns. Eight (out of 14) of these prophets (Amos, Isaiah, Jeremiah, Ezekiel, Joel, Nahum, Haggai, and Zechariah, see attribution in table 1) threatened earthquakes (the “earthquake theophany” of Austin et al. 2010) for manipulation of the laity and to underscore their predictions relative to matters of faith, politics, and future deliverance. These range in age from Amos to about 400 B.C. (Coogan 2011). So this prophetic tradition in the Old Testament spans about 350 years after Amos.

Of course this strategy would not work unless earthquakes were occurring. We have insufficient records of earthquakes in this period to link prophets with individual events, but the average interval between earthquakes in this region is on the order of 60 years (Ben Menahem 1991, Ambraseys 2009), based in part on seismically disturbed layers in Dead Sea sediments (Migowski et al. 2004). So there is reason to suppose that earthquakes were kept in people’s minds.

Earthquakes are destructive, and a theophany based largely on earthquakes would have God’s appearances dreaded. The prophets generally mentioned earthquakes in the context of retribution for the people’s failings. Earthquake prediction must have been a “trump card” in the prophet’s options, though probably few had the good fortune of Amos to see their predictions vindicated within two years (e.g. D. N. Freedman and Welch 1994). Which of the people’s transgressions were to be punished by earthquake seem to evolve through the prophetic literature. It includes polytheism in the pre-Exilic period, toward failing to rebuild the Temple after it, for example. Throughout, it is an essential ingredient in the relentless monotheism we associate with the Old Testament.

Of special interest to geologists is Zechariah 14, which seems to describe particular fault transport directions for a predicted event in this region (“... and half of the mountain shall remove to the north, and half of it toward the south” in KJV), directions that fit the relative motion of the African and Arabian plates along the Jordan Valley, as noted by Yeats et al. (1997).

The prophetic tradition continues into the New Testament with sayings of Jesus quoted in three gospels—Matthew 24:7, Mark 13:8, and
Luke 21:11—invoking earthquakes in a pre-end-times context. Earthquakes occurred at the end of Jesus’ life (Matthew 27:51-54), convincing a centurion of Jesus’ divinity, and at his resurrection (Matthew 28:2-4) with the appearance of an angel, a sort of semi-theophany. Being only three days later in the same place, the Easter quake would appear to be an aftershock. However, neither is attested historically or archaeologically.

In Acts 16:26ff, Paul and Silas were liberated from prison by an earthquake that converted their jailer, and which is quoted by some Christians as a miracle to this day. And of course the book of Revelations (6:12-17, 8:5, 11:13-19, 16:17-21) is “over the top” with earthquake predictions having a threatening edge. Its use of Armageddon, by the way, may hark back to an earthquake of the 10th century BC at Megiddo (Cline 2011). The prophetic drumbeat for over 800 years gave Judeo-Christian culture much of its character, and that character was molded by threat of earthquakes.

Table 1.—Books of the Old Testament listed as in King James Version, with era being described, and type of mention of earthquakes. Causation: T theophanic, S semi-theophanic, M miraculous, N not theophanic

<table>
<thead>
<tr>
<th>Books</th>
<th>Era described (century B.C.)</th>
<th>Earthquakes mentioned</th>
<th>Earthquake causation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genesis</td>
<td>?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exodus</td>
<td>11?</td>
<td>19:18 (incl volc), 20:18, (only volc)</td>
<td>T</td>
</tr>
<tr>
<td>Leviticus</td>
<td>11?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbers</td>
<td>11?</td>
<td>16:30-34</td>
<td>M</td>
</tr>
<tr>
<td>Deuteronomy 1</td>
<td>10?</td>
<td>5:23 (volc only)</td>
<td></td>
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<tr>
<td>Deuteronomy 2</td>
<td>10?</td>
<td>4:11 (volc only)</td>
<td></td>
</tr>
<tr>
<td>Deuteronomy 3</td>
<td>7?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joshua</td>
<td>10?</td>
<td></td>
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</tr>
<tr>
<td>Book</td>
<td>Chapter</td>
<td>Verse Details</td>
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<tr>
<td>-----------------</td>
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<tr>
<td>Judges</td>
<td>10?</td>
<td>5:4 (incl. volc, similar to Ex19:18)</td>
<td></td>
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<tr>
<td>Ruth</td>
<td>?</td>
<td></td>
<td></td>
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<tr>
<td>1 Samuel</td>
<td>10?</td>
<td>14:15</td>
<td>M</td>
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<tr>
<td>2 Samuel</td>
<td>10?</td>
<td>22:8 (same as Psalm 18)</td>
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</tr>
<tr>
<td>1 Kings</td>
<td>9?</td>
<td>19:11</td>
<td>N</td>
</tr>
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<td>9?</td>
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<td>Psalms 1</td>
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<td>18:7, 68:8</td>
<td>M</td>
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<td>5</td>
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<td>Jeremiah</td>
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<td>4:24</td>
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<td>Lamentations</td>
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<td>Ezekiel</td>
<td>6</td>
<td>38:19-20</td>
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<td>Daniel</td>
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Biblical conclusion

Earthquakes accompany God’s appearance to men quite a few times in the Bible, and God causes earthquakes in merely miraculous contexts in a great many more. The theophanic link with earthquakes begins with Moses and extends into the New Testament. The link is particularly heavy-handed in the prophetic tradition beginning with the book of Amos, known to correspond with an earthquake of ca. 760-750 B.C. The prophetic literature after Amos used the threat of earthquake for at least 350 years with no abatement. The New Testament continues this tradition for several hundred more years, thus giving all Judeo-Christian thought patterns one of God-fearing. Earthquakes were a significant tool in the creation of this pattern.

For the purpose of this paper, it seems safe to say that tectonic activity did indeed channel the course of religion in this example, which supplies desired detail, motivation, and dynamics. A key takeaway in my opinion is that tectonic activity can be traced as it became an essential part of the fabric of Judaic religion, and we can still see prominent traces of tectonism in its descendant Christianity, making the Bible a legitimate example of direct relation between tectonism and religion. There are parallels in some respects, though inevitably less well-documented, in other ancient cultures, and similar manipulations can be discerned in some of them (Stewart and Piccardi 2018), especially where volcanism is a factor (Balmuth et al. 2005, Grattan and Torrance 2007).

INTERREGNUM—what have we have established and what we still need
Section I showed that there is a spatial relation between origination sites of modern big religions and on-land plate-tectonic boundaries. Initiation of successful religions would seem to be catalyzed in some way by tectonic activity, mostly seismic activity.

Section 2 showed that tectonic activity, mostly seismic activity, directly or sometimes incidentally has lead to religious reaction, commonly reform, in dozens of examples. This accords with universal human reaction to earthquakes. There seems no reason to look for indirect linkages between earthquakes and religious dynamics.

Section 3 tracked the evolution of one intricately documented example of religious reaction--and use--of seismic activity. These reveal details of the dynamics and motivation, and show that manipulation by priestly classes of the laity is involved, again in accord with records from other ancient cultures.

One is tempted to conclude that initiation and reform of religion is typically catalyzed by seismic events, and continuing evolution of religion can be strongly shaped by active tectonic environments. Religions tend to become more complex and even manipulative in these environments.

What do we need to know in order to further clarify these conclusions? Perhaps religions associated spatially or thematically with active seismicity tend to be of a certain type. Perhaps other types of religions have different distribution patterns. One way to address these possibilities is to look at the flip side of the tectonic coin, i.e. tectonically quiescent areas of the earth, to examine their religious evolutions. Another way to look at this converse case is looking for characteristic patterns in religions never related to tectonic boundaries. We need to look at distributions prior to colonial encroachment, however, if we are aiming at endemic in situ religions.

IV. The converse cases of tectonic quiescence and religious simplicity

A first glance at the distribution of pre-colonial religions in tectonically quiescent continents suggests that religions there are indeed very different from those along plate-tectonic boundaries. These are (or were) preferentially the sites of comparatively simple religions in the huge quiescent parts of Africa, Australia, and the Americas. Of course simplicity can be in the eyes of the (pith-helmeted?) observer, and most world religions can be seen as simple in comparison to those
with such elaborations as original sin, etc. Animism for example has been considered primitive, but modern attitudes embrace some forms of animism.

But the disparity apparent with distribution of tectonic vs. quiescent religions is too great to be explained by relativistic arguments. It’s obvious, which is fortunate as I’m not qualified to make subtle distinctions.

What is the meaning of simple(r) religion? Stasis is probably part of the answer, and of course stasis is difficult to maintain along tectonically active loci. Stasis for many simple religions in tectonically quiescent locales can be demonstrated archaeologically; though migrations may change religious forms there they do not obviously change complexity.

It is true that many of the simple(r) religions are in simpler cultures, and cultural stasis is known to be associated with cultural simplicity (Force 2015 including chapter 13). In this regard the exceptions and outliers of my continent-scale observation are interesting, as they reveal divergences between religious and other cultural responses to tectonic activity vs. quiescence. They can be used to test my stasis hypothesis.

The outliers are tectonically-active loci with simpler religions, some in complex cultures. Perhaps the most obvious example is Shintoism in Japan, traditionally said to be animistic. However, one of the roots of Shinto “animism” regards volcanoes; such veneration goes back to the Kofun period (ca. AD 500; Barnes, in press) when ritual offerings to volcanoes are known. Clearly Shintoism differs from other “simple” religions in reflecting its tectonic environment. In tectonically active Mesoamerica (Plunkett and Urunuela 2005) and many other tectonically active localities both ancient and modern, complex and “simple” (Balmuth et al. 2005, Chester and Duncan 2007), volcano veneration is a part of traditional religions. But the Shinto outlier shows that apparent religious simplicity in a complex culture can be profound in relation to tectonic environment.

Another very different type of outlier is exemplified by California Indians. I have no explanation either in cultural or religious terms. Somewhat similar outliers are numerous all over the SW Pacific. Remember, however, that my hypothesis does not claim that simple religions are RESTRICTED to quiescent tectonic environments, hence these examples are outliers, however educational.
True exceptions take the form of complex religions in tectonically quiescent locales. Proper documentation would seem to involve original areas of evolution, since the simpler religions tend to be endemic. Thus an apparent example of such a true exception is ancient Egypt. I will not claim that Egypt’s religion was simple, but certainly once established it became static for thousands of years. Only once was its stasis interrupted, and stasis was soon restored.

The modern world is full of examples of complex religions in tectonically quiescent terranes, but most are post-colonial. When these examples are subtracted, exceptions still remain; possibly the most obvious is northern Europe--Christian but quiescent. However, Christianity has its roots in tectonically-active SW Asia and spread into Europe via tectonically-active routes, only then spreading into quiescent terrane. At this point Catholic Christianity became theologically static for over a thousand years. So stasis may result where big religions spread away from tectonically active origins. Other examples of such spread exist; complex religions tend to do so (Norenzayam et al. 2016).

Our exploration of converse cases thus far shows few (but revealing) exceptions to the generalization that tectonically quiescent areas tend to have simpler and/or static endemic religions. Religious stasis seems a sufficient reason that quiescent areas generally lack(ed) complex religions, as stasis has prevented evolution. As we have seen in previous sections, tectonic activity has not permitted religious stasis. But religions that originate in tectonically active terrains may become static when they spread beyond those terrains.

V. Tectonic events and religious response--conclusion

I feel that we are led inexorably to conclude that tectonic activity and religious response have been closely related throughout history, even more closely than other cultural responses though perhaps catalyzing them. We see that tectonism spatially corresponds with religious origination, that tectonic events have resulted in known religious responses, that the effect of tectonism can be traced through long-term religious evolution, and that tectonically quiescent areas do not share such evolutions. Other links between culture and tectonics are known but religious links are most common.
Acknowledgements.—Various sections have benefitted from suggestions by Claudio Vita-Finzi, Wayne Howell, E. Charles Adams, Gary Huckleberry, E. H. (Ned) Brown, Lars Fogelin, Johan Elverskog, David Soren, and two anonymous reviewers. I thank Ara Norenzayan for putting me in touch with J. S. Bentzen. Responsibility remains mine.
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